

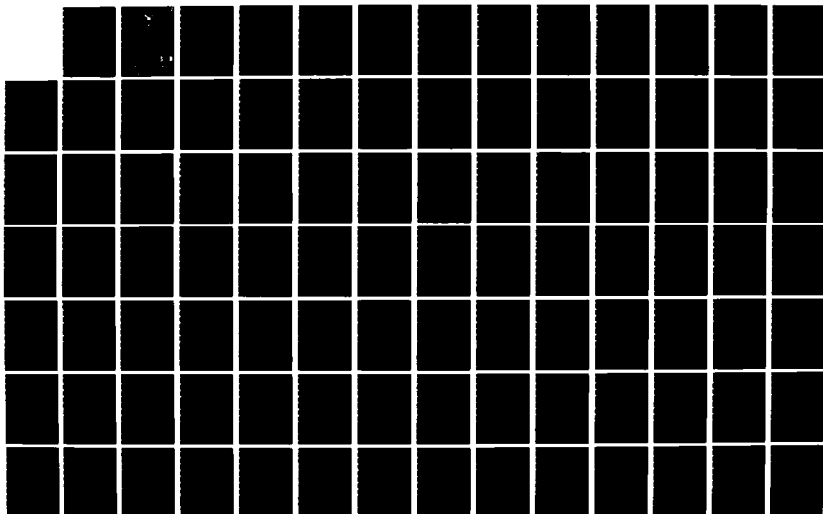
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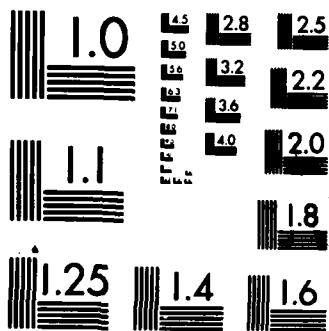
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AN ANALYSIS OF THE PERCEIVED  
COMPETENCE OF JUNIOR CIVIL  
ENGINEERING OFFICERS

Benjamin R. Wilson  
First Lieutenant, USAF

AFIP/GEM/LSB/85S-24

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SECURITY CLASSIFICATION OF THIS PAGE

AD-A160884

## REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION <b>UNCLASSIFIED</b>			1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE			Approved for public release; distribution unlimited	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) <b>AFIT/GEM/LSB/85S-24</b>			5. MONITORING ORGANIZATION REPORT NUMBER(S)	
6a. NAME OF PERFORMING ORGANIZATION <b>School of Systems and Logistics</b>		6b. OFFICE SYMBOL (If applicable) <b>AFIT/LSM</b>		7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State and ZIP Code) <b>Air Force Institute of Technology Wright-Patterson AFB, Ohio 45433</b>			7b. ADDRESS (City, State and ZIP Code)	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (If applicable)		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State and ZIP Code)			10. SOURCE OF FUNDING NOS.	
			PROGRAM ELEMENT NO.	PROJECT NO.
			TASK NO.	WORK UNIT NO.
11. TITLE (Include Security Classification) <b>See Box 19</b>				
12. PERSONAL AUTHOR(S) <b>Benjamin R. Wilson, 1 Lt, USAF</b>				
13a. TYPE OF REPORT <b>MS Thesis</b>		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Yr., Mo., Day) <b>1985 September</b>
15. PAGE COUNT <b>95</b>				
16. SUPPLEMENTARY NOTATION				
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB. GR.		
<b>13</b>	<b>02</b>		<b>Civil Engineering, Training, Job Training, Behavioral Science</b>	
19. ABSTRACT (Continue on reverse if necessary and identify by block number)				
Title: <b>AN ANALYSIS OF THE PERCEIVED COMPETENCE OF JUNIOR CIVIL ENGINEERING OFFICERS</b>				
Thesis Chairman: <b>Robert P. Steel</b> <b>Associate Professor of Organizational Behavior and Management</b>				
Approved for public release: LAW AFR 190-17. <i>Benjamin R. Wilson</i> 11 Sept 85 <b>LYNN E. WOLTER</b> Dean for Research and Professional Development Air Force Institute of Technology (AFIT) Wright-Patterson AFB OH 45433				
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <b>UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS <input type="checkbox"/></b>			21. ABSTRACT SECURITY CLASSIFICATION <b>UNCLASSIFIED</b>	
22a. NAME OF RESPONSIBLE INDIVIDUAL <b>Robert P. Steel, Associate Professor</b>		22b. TELEPHONE NUMBER (Include Area Code) <b>513-255-4549</b>		22c. OFFICE SYMBOL <b>AFIT/LSB</b>

↙ Civil Engineering (CE) officers are sent directly to their first duty station without any job related training. This lack of training could cause new CE officers to be unprepared for their job. The perceived competence of officers was used to determine how well prepared CE officers are for their first assignment. Civil Engineering second lieutenants were surveyed to determine their perceptions of their overall competence, technical competence, managerial competence, and knowledge of the CE organization. Supervisors also rated each officer in these four areas. The data was statistically analyzed to determine if time in service, prior military service, academic degree, source of commission, and attendance at Air Force Institute of Technology (AFIT) School of Civil Engineering courses affect perceived competence. The results indicate that time in service, source of commission, and the number of courses attended at AFIT have a significant effect on perceived competence. The results also show that prior military service, academic degree, and the AFIT Introduction to Base Civil Engineering course have no significant effect on perceived competence. An important finding was that supervisors rated officers significantly higher in competence than the officers rated themselves. The conclusions were that more job familiarization is needed for new CE officers and attendance at AFIT technical courses should be highly encouraged for young officers. (THESIS) ↘

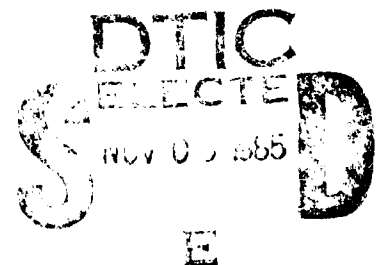
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Benjamin R. Wilson  
First Lieutenant, USAF

AFIT/GEM/LSB/85S-24

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AN ANALYSIS OF THE PERCEIVED COMPETENCE OF JUNIOR CIVIL  
ENGINEERING OFFICERS

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Engineering Management

Benjamin R. Wilson, B.S.M.E.

First Lieutenant, USAF

September 1985

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## Preface

This study was undertaken because of my personal experiences as a new Civil Engineering officer in the Air Force. I had never heard of Air Force Civil Engineering until I received a letter in ROTC class from the Air Force late in my senior year of college. This letter informed me that I was going to be an Air Force Civil Engineering officer in two months. Needless to say, I was confused as why they chose me, a mechanical engineer, to be a civil engineer, and I had no idea what my job would be.

I did some research into Air Force Civil Engineering while at school but I arrived at my first duty station with very little knowledge of my new job. Because of my experience and informal discussions with other junior officers, I decided to do some research into the perceptions of junior CE officers like myself to see if they felt the same way that I did. That was my motivation for this research project.

Although some of my hypotheses were not supported by this study, there are some results of practical significance. The results also indicate that further research is needed to improve the way the Air Force prepares its junior CE officers for their first assignment.

There are several people I would like to thank for their guidance and support throughout this long process.

First, I would like to thank my wife, Karen, for her understanding during the last two hectic months of the project as I tried to put everything together. I would also like to thank my reader, Major Donald E. Murphy for his guidance, especially in the Civil Engineering aspects of the research. Finally, I would like to thank my advisor, Dr. Robert P. Steel, for all of his effort, from helping me choose my topic all the way through writing the final draft.

Benjamin R. Wilson

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Abstract

Civil Engineering (CE) officers are sent directly to their first duty station without any job related training. This lack of training could cause new CE officers to be unprepared for their job. The perceived competence of officers was used to determine how well prepared CE officers are for their first assignment. Civil Engineering second lieutenants were surveyed to determine their perceptions of their overall competence, technical competence, managerial competence, and knowledge of the CE organization. Their supervisors also rated each officer in these four competence measures. The data was statistically analyzed to determine if time in service, prior military service, academic degree, source of commission, and attendance at Air Force Institute of Technology (AFIT) School of Civil Engineering courses affect perceived competence. The results indicate that time in service, source of commission, and the number of courses attended at AFIT have a significant effect on perceived competence. The results also show that prior military service, academic degree, and the AFIT Introduction to Base Civil Engineering course have no significant effect on perceived competence. An important finding was that supervisors rated the officers significantly higher than the

officers rated themselves. The conclusions were that more job familiarization is needed for new CE officers and attendance at AFIT technical courses should be highly encouraged for young officers. The fact that supervisors rated the officers significantly higher than the officers rated themselves leads to the conclusion that there may be a problem in the preparation of junior CE officers and more research is needed in this area.

# AN ANALYSIS OF THE PERCEIVED COMPETENCE OF JUNIOR CIVIL ENGINEERING OFFICERS

## I. INTRODUCTION

### General Issue

An important issue in today's Air Force is whether the current preparation of junior Civil Engineering (CE) officers is consistent with the demands of their job assignments. This issue is important for two reasons. First, if current preparation is consistent with the job demands, the system is working and will not require a major overhaul. Conversely, if the preparation of junior CE officers is deficient, then changes may need to be made in the current methods of preparation. The second reason is that with the current shortage of experienced CE officers, the Air Force must prepare junior officers better in order to increase their productivity (Rumsey, 1982).

### Specific Problem

Within the general issue of preparation of junior CE officers, the specific problem to be addressed is measuring the perceived competence of these officers in performing their assigned duties. By measuring their feelings of competence, the adequacy of their preparation for the job can be determined. In addition, the factors that affect job

competence can be studied. If the officers express a high degree of competence in accomplishing their job tasks, then their preparation for the job would appear to have been sufficient. On the other hand, if their felt level of competence is low, then some areas of preparation may need to be improved.

There are four general areas of task competence that need to be measured for CE officers. The first area is overall, or global competence in carrying out all of the duties of the job. The second area is technical competence, which relates to the technical engineering skills required for the job. Managerial competence is the third area, and this area concerns the ability to manage the people and resources of the job. The final area of competence to be measured is knowledge of the CE organization and mission.

Measuring the level of competence of junior CE officers is the most important problem to be solved, but determining the factors that influence the level of competence is also a major thrust of this study. Several experience and educational factors will be examined to determine their effect on the level of competence expressed by CE officers. Experience factors include the amount of time in service as a commissioned officer, whether the officer had prior enlisted service, and the source of commission for the officer (U.S. Air Force Academy (USAFA), Reserve Officer Training Corps (ROTC), or Officer Training School (OTS)). Educational

factors were also studied. The type of undergraduate academic degree possessed by the officer was examined as an influence on competence. This degree can be in civil engineering, electrical engineering, industrial engineering, mechanical engineering, general engineering, or architecture (Department of the Air Force, 1977). Another educational factor dealt with whether the officer attended the Introduction to Base Civil Engineering course at the Air Force Institute of Technology (AFIT) School of Civil Engineering. Also, the number of additional courses the officer attended at AFIT's CE school was examined as an antecedent of competence. The final factor is how well the subject matter in the AFIT courses prepared the officer for his job.

## II. LITERATURE REVIEW

### Background

Preparation is defined as "the action or process of getting ready for duty" and "making something ready for use or service" (Merriam-Webster, 1976:1790). The way to measure preparation is to measure how ready a person is for duty, use, or service. The degree of competence a person has in carrying out his job duties will give an indication of how ready the person is for those duties. To measure the actual competence of individuals would be very difficult, so a measure called sense of competence was developed. Sense of competence is defined as "the cumulative set of feelings of confidence and competence an individual has from repeatedly and successfully mastering his external environment" (Morse, 1976:1195). A more practical definition, especially in the context of this paper, is an individual's subjective feelings and confidence about his or her ability to master his organizational and work environment (Morse, 1976). Sense of competence is the subjective side of an individual's actual competence and thus measures only the internal feelings an individual has about his competence in the work setting (Morse & Wagner, 1975).

Although the term sense of competence is used in this thesis, the concept has been referred to as self-acceptance,

self-confidence, self-respect, self-satisfaction, self-worth, and self-ideal congruence by other authors (Tharenou, 1979). The use of all of these terms interchangeably can be confusing though. Sense of competence, the major concept underlying this study, is concerned with self-esteem as related to specific tasks. In her extensive literature review on self-esteem, Tharenou (1979) discusses all types of self-esteem; global, specific, and task specific. Although all of these types of self-esteem are important, one must remember that task specific self-esteem is the key construct in this study.

Two important concepts that are used throughout this study are correlation coefficient,  $r$ , and  $p$ -value,  $p$ . The correlation coefficient represents the strength of the relationship between two variables and ranges from a low of .00 (no correlation) to a high of 1.0 (perfect correlation). The  $p$ -value represents the significance level beyond which a given statistic (e.g.  $r$ ) is statistically significant. The standard critical level for this study and most management research is .05. For example, if a  $p$ -value associated with a given correlation coefficient was .04, this correlation would be regarded as significantly different from a value of zero. A  $p$ -value of less than .01 was regarded as highly significant in this study and a  $p$ -value of less than .10 was considered to be marginally significant.  $P$ -values are reported in this study for tests of the differences between

the mean scores of two groups (i.e., t-tests), and to determine if correlation coefficients were significantly different from zero.

### Origins of Competence Research

One of the earliest investigations into sense of competence was performed by R. W. White (1959, 1963) who proposed that "there is a basic, even biological, urge or drive in all individuals to influence and master their environment" (Morse & Wagner, 1975:451). Because of this urge or drive to master their environment, individuals will look for situations that increase their self-esteem and avoid situations that might lower their self-esteem (Hall, 1971). Since White's early work, there have been many studies investigating factors that correlate with sense of competence and self-esteem.

### Work Role Correlates of Competence

One factor that may lead to low self-esteem is qualitative role overload (French & Kaplan, 1972). This occurs when a person does not have the skills, abilities, and knowledge required for the job. Likewise, role ambiguity or lack of role clarity is associated with low self-esteem and competence (Tharenou, 1979).

The amount of autonomy a job provides has been found to be positively associated with work-specific self-esteem and competence (Tharenou, 1979). In a study by Sekaran and

Wagner of 545 American white-collar clerical and first-line supervisory employees, sense of competence and autonomy were correlated ( $r = .28$ ,  $p < .05$ ). This study also provided results for a sample of 1,123 workers in India and the correlation coefficient between competence and autonomy was .32, significant at  $p < .05$  (Sekaran & Wagner, 1980). Closely associated with autonomy is job challenge. A challenging job can have many positive effects including increased self-esteem, competence, and commitment to the job (Tharenou, 1979; Hall, 1971).

A third intrinsic characteristic that has been positively correlated with sense of competence is meaningfulness of the work. Meaningfulness of the work is defined as the "employee's perception that the job he or she does is valuable and worthwhile" (Sekaran & Wagner, 1980:344). Sekaran and Wagner found sense of competence and meaningfulness of work significantly correlated for both an American sample ( $r = .39$ ) and an Indian sample ( $r = .44$ ).

Sense of competence may have a considerable effect upon career choice and the congruence between an individual and his work role. An individual will generally choose a career role that he values and in which he is competent or in which he expects to be competent (Hall, 1971). A high self-esteem individual will be more likely to choose a difficult career that requires a high ability level. This leads to the area of congruence. In general, the higher an

individual's self esteem, the more congruence there will be between his work role, or what is expected of him, and his actual abilities and attributes (Hall, 1971). A person who has a high sense of competence is also more likely to be in a job where he feels he is competent and will have a better orientation toward his environment (Korman, 1967; Feldman, 1976). Wagner and Morse (1975) concurred on the importance of congruence when they state that "A sense of competence . . . provides a psychological construct linking the individual and the organization in a manner that allows the goals of both to be met and even to reinforce one another" (p. 458).

#### Personal Factor Correlates of Competence

The education level of an individual may also have an effect on his or her sense of competence. In a study of 123 auto workers, education level and sense of competence were significantly correlated (Ekpo-Ufot, 1976). The author concluded, "In general the higher one's educational status the higher the self-estimate he makes of his possession of job relevant abilities" (Ekpo-Ufot, 1976:411).

Sense of competence has also been correlated with organizational commitment. In a study of 506 employees of three health care institutions, sense of competence was found to be strongly correlated ( $r = .56$ ) with organizational commitment ( $p < .01$ ) (Morris and Sherman, 1981).

### Contextual Correlates of Competence

Supervisory support has also been positively associated with work role self-esteem and feelings of task competence. This association has been found for competence related to specific tasks but not for overall or global competence (Tharenou, 1979). Hackman and Lawler (1971) studied many job characteristics of telephone company employees and found that there was a significant ( $p < .05$ ) correlation of .31 between task specific self-esteem and the amount of close supervision received.

Another factor, the work environment, may have a significant effect on the self-esteem of employees. In his book on organizational behavior, Korman (1977) described two work environments and their effects on self-esteem. Korman characterized environment A as a traditional organization with a strong hierarchy of authority, little employee latitude and discretion, with most activities programmed and controlled by rules. In contrast, Korman's environment B had a weak hierarchy with an emphasis on self-control, few programmed activities, and all organizational levels participated in the development of organizational objectives. Korman states that environment A will promote low self-esteem because the excessive control in the organization reflects a lack of confidence in the employees. A democratic organization like environment B will promote high self-esteem (Korman, 1977).

### Outcomes of Competence

Ekpo-Ufot (1976) found that labor turnover was related to sense of competence. He obtained a correlation coefficient of  $-.27$  ( $p < .01$ ) between sense of competence and labor turnover. The author concluded that employees with a high sense of competence were more likely to stay at their job than those with a low sense of competence.

The most heavily researched outcome of sense of competence is job performance. Many studies have yielded positive correlations between sense of competence and performance. Ezekiel (1968) studied Peace Corps volunteers and their predictions of their future, concentrating on the concept of competence. He then compared these predictions to their performance reports for the next two years and found a significant correlation between the individual's feelings of competence and his or her actual performance.

In another study, Friedman and Goodman (1967) found that subjects who felt they were fully qualified for the task had significantly ( $p < .02$ ) higher production rates than those who did not feel they were qualified to perform the task.

Korman (1970) performed a series of laboratory studies dealing with the sense of competence-performance relationship. In the first experiment, the subjects were divided into two groups, high self-esteem subjects ( $n=45$ ) and low

self-esteem subjects ( $n=40$ ). The subjects were then given several tasks varying in difficulty. The high self-esteem subjects completed significantly ( $p < .05$ ) more difficult tasks than the low self-esteem subjects. The experiment also found no significant difference between the two groups in the performance of easy tasks.

The second experiment by Korman (1970) was similar to the first but the tasks were creative tasks. The findings were similar to the first experiment in that the high self-esteem subjects performed significantly ( $p < .025$ ) better than low self-esteem subjects.

The third and final experiment by Korman (1970) manipulated the immediacy of feedback on the individual's performance. The results of this experiment showed the difference in performance between the high self-esteem subjects and the low self-esteem subjects to be marginally significant ( $p < .06$ ). The author concluded that "Self-perceived competence for a task seems to facilitate performance on the task, particularly if the task provides one knowledge of how close/far he is to goal achievement" (Korman, 1970:39).

Badin and Greenhaus (1974) conducted a study of 144 undergraduate students assessing the correlation between perceived task competence and task performance. They found a significant correlation between the two variables of  $r = .31$ . This result supports the authors' contention that

high self-esteem individuals are motivated to perform well to keep their performance consistent with their self-image and conversely, low self-esteem individuals will not be as motivated to perform well since a high level of performance would not be consistent with their self-image.

Another study, by Ekpo-Ufot (1979), examined the relationship between perceived competence and supervisory performance ratings for 88 clerical workers in a federal government ministry in Nigeria. The results yielded a significant and positive correlation ( $r = .23$ ,  $p < .05$ ) between perceived competence and supervisory performance ratings. The author concluded that "employees who retained a high self-concept of job relevant abilities tended to be rated high in their job performance by their superiors" (Ekpo-Ufot, 1979:432).

A study by Lorsch and Morse (1974) examined the relationship between sense of competence and organizational performance in four manufacturing organizations and six research organizations. Two of the manufacturing organizations were considered high performers and two were considered low performers. Similarly, three of the research organizations were rated as high performers and the others were rated as low performers. The authors utilized two tests to measure sense of competence. The first test consisted of a set of ambiguous pictures of people at work in which the respondents were asked to describe each situation.

The second test required the respondents to describe what their next day at work would be like. The study found that there was a significant difference in the mean individual competence scores between high performing and low performing organizations ( $p < .01$ ).

A major study of sense of competence was performed by Wagner and Morse in 1975. They developed a 23 item instrument to measure an individual's sense of competence. This instrument has been utilized in several studies examining the sense of competence-performance relationship.

This instrument was used in two studies to determine the relationship between sense of competence and organizational performance. The first study examined two groups from an aerospace company, one of which was rated a high performer ( $n=44$ ) and the other a low performer ( $n=22$ ). The results revealed that the mean score on the Wagner and Morse instrument for the high performing group was significantly ( $p < .001$ ) higher than the mean score for the low performing group.

The second study, performed in four units of a county government, found that the two effective units scored significantly higher than the two less effective units. The authors suggested that when an individual strives for the intrinsic reward of a sense of competence, effective organizational performance will result (Morse & Wagner, 1975).

The Morse and Wagner study only measured organizational performance, not individual performance. For this reason, Morse (1976) conducted a study to examine the sense of competence and individual performance relationship by administering the Wagner and Morse instrument to 123 low, mid, and high-level managers in two large organizations. Three separate performance measures were collected six months after the sense of competence instrument was administered. Two of the performance measures were performance rankings collected by the company based on economic data and a critical incident behavioral assessment. The third performance measure was a 51 item self-report instrument describing roles, activities, and behaviors that an effective manager would engage in.

All of the correlations were significant ( $p < .001$ ) and the correlation coefficients were .67 for the economic based measure, .59 for the critical incidents measure, and .75 for the activity rating.

Tharenou and Harker (1982) performed a study on 166 electrical apprentices to measure their sense of competence. In this initial study, they found that there was not a significant correlation between sense of competence and performance. But Tharenou and Harker (1984) performed a second study 20 months later on 92 of the original subjects and in this study, they found that there were significant correlations between sense of competence and rated perform-

ance. The authors found these correlations to be significant for both self-rated performance ( $r = .25$ ,  $p < .05$ ) and for supervisor-rated performance ( $r = .31$ ,  $p < .01$ ).

Development of a survey measure of sense of competence has led to many other studies evaluating the validity of the competence measure.

### Civil Engineering Career Field

Civil Engineering Mission. Civil Engineering (CE) has two missions, one peacetime and one wartime. The peacetime mission is to "acquire, construct, maintain, and operate real property facilities, and provide related management, engineering and other related support work" (Department of the Air Force 1983:2). The wartime mission includes such functions as emergency repair of war damaged bases, force beddown of Air Force units and weapon systems, operations and maintenance of Air Force facilities, crash rescue and fire suppression, and construction management of emergency repairs (Department of the Air Force, 1983).

CE Officer Education. The most important requirement for entering the CE career field is having a degree in a specified discipline. The officer must have a bachelor's degree in architecture, architectural, civil, electrical, industrial, or mechanical engineering; or have graduated from a service academy with a major in an engineering discipline (Department of the Air Force, 1977). If the officer

has the required degree and is selected for the CE career field, he is sent directly from commissioning to his first duty station. No specialized training is given to the officer before he enters his first job. After the officer has entered his job, most of his training is on-the-job. The exception to this is professional education at the Air Force Institute of Technology School of Civil Engineering.

The School of Civil Engineering, located at Wright-Patterson AFB, Ohio, is a resident school that offers professional continuing education for CE personnel. The school offers both technical and management courses "designed to broaden and update the professional knowledge of Air Force Civil Engineering engineers and managers" (Department of the Air Force, 1984:2). The most important course for a junior Civil Engineering officer is the Introduction to Base Civil Engineering course which provides officers entering the career field with an overview of CE operations. The subjects include the CE organization, management systems, techniques, operations, work requirements, resources, and professional development. The recommended time frame for attendance at this course is three to six months after entering the career field (Department of the Air Force, 1984).

There are several other courses that are critical for junior officers to be productive in their first assignment. These include Pavements Engineering, Electrical Engineering,

and Heating, Ventilating, and Air Conditioning (HVAC). These courses are designed to give the engineer practical training in his technical specialty to augment his general undergraduate education.

The educational background and experience of a CE officer may have a significant effect on his or her sense of competence, especially for officers commissioned through ROTC or the Air Force Academy. Since most officers with civil engineering undergraduate degrees work in the CE career field, they should know early in their college career that they will be a CE officer and thus can prepare for that job. For electrical, industrial, and mechanical engineers, the Civil Engineering career field is only one of many career fields available to them. Thus, an officer with one of these three degrees cannot prepare for the CE career field and may not feel as competent in his or her first job. Educational background may not be as significant for officers commissioned through OTS since some of them may not have planned on joining the Air Force during college. They may have worked as a civilian engineer after college and later decided to enter the Air Force.

The electrical, industrial and mechanical engineers may benefit from attending the AFIT CE school for the general Introduction to Base Civil Engineering course and technical courses for each engineering discipline.

The amount and type of previous experience both as an engineer and as a military member might also affect the officer's sense of competence. An officer with more military experience, either as an officer or an airman, should be more familiar with military procedures and thus feel more competent in his or her job.

The final factor that might affect sense of competence is the source of commission of the officer. Officers who receive their commission through ROTC are not assigned to a career field until late in their senior year in college, so they have little time to prepare for their new job. Officers commissioned through OTS, on the other hand, know what their career field will be when they begin their officer training. Officers who attend the Air Force Academy live in a military environment for four years and thus should have an easier transition to active duty.

#### Research Objectives

In order to investigate the adequacy of the preparation of junior CE officers, there are three research objectives that must be accomplished:

1. Measure the sense of competence of junior CE officers to see if they are prepared for their job assignments.
2. Measure the sense of competence of junior CE officers as judged by their supervisor to see if they are prepared for their job assignments.

3. Determine if time in service, prior service, source of commission, academic degree, attendance at AFIT's Introduction to Base Civil Engineering Course, and the number of courses attended at AFIT affect the degree of competence of junior CE officers as reported by themselves and their supervisors.

### Hypotheses

There are eight hypotheses to be addressed in this study.

1. Time in service as a commissioned officer will be positively correlated with overall competence, technical competence, managerial competence, and background knowledge of the CE organization.
2. Officers with prior enlisted service will be rated higher in overall competence, managerial competence, and background knowledge than officers without prior enlisted service.
3. Officers who received their commission from the USAFA or OTS will be rated higher in background knowledge than officers who received their commission from ROTC.
4. Officers with civil engineering undergraduate degrees will be rated higher in overall competence, technical competence, and background knowledge than officers with electrical, industrial, or mechanical engineering degrees.

5. Officers who have attended the Introduction to Base Civil Engineering course at AFIT will be rated higher in overall competence and background knowledge than officers who have not attended the Introduction to Base Civil Engineering course.
6. The number of courses attended at the AFIT School of Civil Engineering will be positively correlated with overall competence, technical competence, and background knowledge.
7. How well the subject matter at the AFIT School of Civil Engineering prepared the officer for his job will be positively correlated with overall competence, technical competence, and background knowledge.
8. Officers will rate themselves higher on all four of the competence measures than their supervisors will rate them on the four measures.

### III. METHOD

The general method of this research project involved a survey with a statistical analysis of the data. The survey combined a standard instrument developed by Wagner and Morse (1975) with a new instrument designed specifically for CE officers. The survey was sent to a sample of junior CE officers and their supervisors for completion. The data were then loaded into a computer for statistical analysis.

#### Justification

There are several reasons why the survey approach was chosen for this research problem. The first and foremost reason is that there was no data currently available for analysis of this problem; thus, data had to be gathered. This problem did not lend itself to experimentation due to the fiscal and time constraints. Since there is no practical method of measuring objective levels of competence, the perceived competence of the individual, his sense of competence, was measured. This reduced the methodological alternatives to a survey or interview. Again, due to the fiscal and time constraints, the interviewing approach was not feasible. It would take many interviews to get a representative sample large enough to draw valid conclusions about the effects of the factors (time in service, academic degree, etc.) relating to sense of competence.

### Sample Description

The population of interest was all junior CE officers. The definition of a junior CE officer is a commissioned officer in the CE career field with less than two years commissioned experience. The figure of two years was chosen so that most respondents would be at their first assignment. The population consisted of all second lieutenant CE officers with a date of rank of 16 March 1983 or later working in a base level CE organization in the Continental United States. The population contained approximately 420 individuals.

There were actually three samples of CE officers that participated in this research. The first sample was 38 individuals who met the criteria and attended AFIT's Introduction to Base Civil Engineering course in January 1985. A second sample of 24 qualified individuals was obtained from the Introduction to Base Civil Engineering class held in March 1985. Finally, surveys were mailed to 268 individuals who had not previously participated in the survey. This third sample was stratified in order to obtain representative samples of officers with different engineering degrees. A random sample of 110 subjects with civil engineering undergraduate degrees were chosen. In addition, a census was taken of individuals with architecture, electrical engineering, industrial engineering, and mechanical engineering degrees. A census was taken of individuals in these

groups to insure that there would be enough cases in each group to perform comparative analyses. Responses were obtained from 41 architects, 45 electrical engineers, 25 industrial engineers, and 47 mechanical engineers. The following paragraphs give some descriptive data on the sample. A complete list of descriptive data is contained in Appendix A.

The average officer in the sample had been a CE officer for approximately twelve months, and 29% of the officers had prior enlisted service. The source of commission varied with 57% commissioned through OTS, 38% through ROTC, and 5% through the Air Force Academy. Few officers had prior engineering experience with 65% of the respondents having no experience and only 12% having more than 12 months of prior engineering work experience.

The AFIT Introduction to Base Civil Engineering course was well attended with 71% of the officers having attended the course. This figure is somewhat distorted by the fact that 62 respondents were surveyed while attending the course. For the random sample that received the mailed questionnaire, 62% of the officers had attended the course. The average officer had attended one AFIT course in addition to the Introduction to Base Civil Engineering course, but 44% of the sample had not attended any courses except the Introduction to Base Civil Engineering course.

Most of the officers (76%) worked in the Engineering and Environmental Planning Branch of their Civil Engineering organization, while 12% worked in Industrial Engineering and 2% each worked in Readiness and Requirements/Logistics. There were some officers (8%) in other unique jobs such as Squadron Section Commander or Missile Engineering.

The sample included the following breakdown by academic degrees: architects,  $n = 32$  (13%); civil engineers,  $n = 109$  (44%); electrical engineers,  $n = 30$  (12%); general engineers,  $n = 2$  (1%); industrial engineers,  $n = 30$  (12%); mechanical engineers,  $n = 37$  (15%); and other degrees,  $n = 7$  (3%).

#### Officer Survey Instrument

The instrument used to measure the sense of competence of the CE officers in the sample contained 44 items designed to measure five areas. The first area was a measure of demographic data about each officer. The second area is overall or global competence. One problem with previous self-esteem studies is that they have too often measured only global self-esteem rather than specific types of self-esteem such as task specific self-esteem (Tharenou, 1979). Because of this and the varied tasks of a CE officer, three other areas were measured; technical competence, managerial competence, and knowledge of the CE organization and mission. The complete officer survey instrument is presented in Appendix B.

Demographic Data. The demographic items in the survey were designed to gather background information on each respondent. The first item measured the amount of active duty military service the individual had as a CE officer. The respondent was given six responses ranging from "0-3 months" to "more than 24 months". Prior service solicited a yes-no response to an item asking whether the officer had any prior active duty service before becoming a CE officer.

The respondent was then asked whether he received his commission from the Reserve Officer Training Corps, Officer Training School, the U. S. Air Force Academy, or some other source. This item measured source of commission.

Another item attempted to determine in which engineering discipline the officer received his undergraduate degree. The choices were architectural, civil, electrical, general, industrial, mechanical, or other engineering discipline.

Next, the respondent was asked in which Base Civil Engineering section was he currently working? The six specific alternatives were listed with one "other" response. The six specific alternatives were Engineering Design, Environmental and Contract Planning, Contract Management, Readiness, Requirements/Logistics, and Industrial Engineering.

In order to determine the amount of prior experience an individual possessed, an item assessed the extent of work

experience the officer had which was related to his current position and was obtained prior to his or her commissioning. The response alternatives were no experience, less than six months, six to twelve months, and more than twelve months.

A simple yes or no answer was requested for an item dealing with attendance at the AFIT Introduction to Base Civil Engineering course, and additionally, an item measured the number of AFIT courses attended excluding the Introduction to Base Civil Engineering course. The six responses for this item were none, one, two, three, four, and more than four.

A final demographic question asked how well the subject matter covered in AFIT courses prepared the officer for his current job. One response alternative was used to indicate if the officer had not attended any courses, and the other four responses ranged from (2) "the subject matter did not prepare me at all" to (5) "the subject matter prepared me exceptionally well."

Overall Sense of Competence. Overall sense of competence was a broad, general measure of an individual's competence in carrying out all the duties of his or her job. It did not concentrate on any one aspect of a job. The instrument used to measure overall sense of competence was based on an instrument developed by Wagner and Morse (1975). Morse (1970) had previously developed an instrument for measuring sense of competence, but it had proven to be very

complex and required trained scorers with special scoring manuals (Tharenou, 1979; Morse & Wagner, 1975). The Wagner and Morse (1975) 23 item instrument was refined from 93 original items and was designed to be applicable across many types of organizations.

The original instrument consisted of 23 items measuring four factors identified by Morse and Wagner (1975) in a factor analysis. These factors were: (1) overall competence; (2) task knowledge (the ability to solve work related problems); (3) influence (a measure of an individual's control over his environment); and (4) confidence (trust and faith in one's self). Eighteen of the twenty-three items from the Wagner and Morse instrument were used in the officer competence questionnaire. Items were scaled on seven point Likert-type scales with responses ranging from strongly disagree (1) to strongly agree (7) with a neutral response of neither agree or disagree (4). Measures of all four of the factors were included in the officer survey, but the greatest emphasis was on measuring the overall competence and task knowledge factors.

In the officer survey, overall competence was indexed with 7 items such as "This job offers me a chance to test myself and my abilities" and "Doing this job well is a reward in itself."

Wagner and Morse's task knowledge factor was appraised by 6 items including "I meet my own personal expectations

for expertise in doing this job" and "I nonestly believe I have all the skills necessary to do this job well."

The influence factor was measured by 3 items such as "Sometimes I feel like I'm not getting anything done" (negatively scored) and "Even though the work here could be rewarding, I am frustrated and find motivation continuing only because of my paycheck" (negatively scored).

The final factor of the Morse and Wagner instrument was confidence and this instrument consisted of 3 items which loaded on this factor. These items included "I do not know as much as my predecessor did concerning this job" (negatively scored) and "If anyone here can find the answer, I'm the one."

In their initial study using the sense of competence instrument, Morse and Wagner (1975) calculated a reliability coefficient of .96, based on the Kuder-Richardson method. Reliability is a measure of how accurate, on the average, the estimated scores of an instrument are. The reliability coefficient ranges from .00 (all error is due to measurement) to 1.00 (no error is due to measurement) (Hull and Nie, 1981). The reliability coefficients for the instrument used in this study were all calculated using the Cronbach alpha method. In a study of U. S. and Indian managers, Sekaran and Wagner (1980) used five of the original 23 items from the Wagner and Morse instrument. They calculated a Cronbach alpha of .78 for the 5 item instrument. When they

applied the formula by Magnuson (1967) for correcting for their test length to the original Wagner and Morse length, the Cronbach alpha was .94.

Reliability analysis of all the 19 items for the composite instrument used in this study yielded a Cronbach alpha coefficient of .85.

Snyder and Morris (1978) attempted to replicate the four factor structure found in the Wagner and Morse (1975) study, found that only the first three factors were reliable across different samples and settings. In addition, they recommended reducing the instrument to 15 of the original 23 items. They used the Spearman-Brown formula and the reliability coefficients were .75 for Factor I (overall competence), .72 for Factor II (task knowledge), and .63 for Factor III (influence). The component instruments used in this study had the following Cronbach alphas; Factor I, .72; Factor II, .72; Factor III, .67; and Factor IV, .68.

Technical Competence. An important aspect of a CE officer's job involves technical engineering competence. The job description for CE officers includes "engineering responsibilities for the construction, maintenance, and repair of Air Force real property ..." and "performs technical civil engineering functions" (Department of the Air Force, 1977:A15-2,A15-5). Some specific skills demanded of a typical CE officer are conducting technical research, preparing feasibility studies, evaluating effectiveness of

CE operations, and preparing and reviewing construction contracts, specifications, and drawings (Department of the Air Force, 1977). As an engineer, the CE officer must be competent in the technical aspects of the job.

The items used to measure technical sense of competence were similar to the Wagner and Morse items, but they were tailored to the technical aspects of the work. There were a total of six items used, and they included statements such as "This job offers me a chance to test myself and my technical abilities", "I honestly believe I have all the technical skills necessary to perform this job well" and "If I were deployed with a Prime Base Engineer Emergency Force (Prime BEEF) team, I could solve any technical problems that might arise." As with the overall competence measure, a seven point Likert-type response scale was used ranging from strongly disagree (1) to strongly agree (7). In this study the Cronbach alpha for these six items was .65.

Managerial Competence. The third element of competence that was measured was managerial competence. All CE officers are required to manage; their job description includes such functions as planning, organizing, directing, and coordinating (Department of the Air Force, 1977). These functions are considered to be the basic functions of management (Donnelly, Gibson, & Ivancevich, 1984). Although engineering education today usually provides an adequate

technical background, the background given to students in the principles of engineering management is generally inadequate (Cleland & Kocaoglu, 1981). It is essential that engineers be familiar with the "concepts, tools, and methods of rational decision making . . ." (Cleland & Kocaoglu, 1981:12).

Seven items were used to measure the managerial competence of CE officers. These items are also similar to the Morse and Wagner items, but again they were tailored to the managerial aspects of the job. The six items included "I meet my own personal expectations for managerial and supervisory expertise in doing this job", "I plan and organize my work in an effective and efficient way", and "I could effectively manage and lead a deployed Prime BEEF team as a team chief." The same seven point scale was used as before. The Cronbach alpha for this measure of managerial competence was .62 .

Knowledge of Civil Engineering Organization and Mission. The final area of competence that was measured was knowledge of the CE organization and mission. Many of the functions of a CE officer require a knowledge of both the CE mission and the organization. These functions include program formulation, policy development, training of military engineering forces, and command of civil engineering activities (Department of the Air Force, 1977).

Four items were used to measure the officer's sense of competence in knowledge of the CE organization and mission. The first item was "I honestly believe I have all the knowledge of each of the branches of Civil Engineering necessary to perform this job well." The three other items were worded similarly but with specific branches inserted such as knowledge of Engineering and Environmental Planning, Operations, and Prime BEEF. With the same seven point scale, the Cronbach alpha was .85 for this measure.

#### Supervisor Survey Instrument

A common problem with competence studies in the past is a lack of multiple measures. Many studies have used only self reported data with no other measurement techniques (Tharenou, 1979). This instrument was designed to measure the supervisor's assessment of the officer's task competence covering the same areas that the officer evaluated himself. The survey instrument administered to the supervisors was similar to the officers' instrument, but the items were worded for the supervisors. In addition, no demographic information was collected from the supervisors. The supervisory instrument was intentionally kept short to increase the response rate. A complete supervisor survey is in Appendix C.

Overall Competence. The supervisor's rating of overall officer competence consisted of nine items based on the Morse and Wagner items. Examples of these items were

"No one knows this job better than this officer does" and "I honestly believe this officer has all the skills necessary to perform this job well." The supervisory instrument utilized the same 7 point Likert-type scale ranging from strongly disagree (1) to strongly agree (7). The reliability analysis for this measure of competence yielded a Cronbach alpha of .84 for the nine items.

Technical Competence. Supervisory evaluations of subordinate technical competence were measured by three items. These items included "This officer meets my own personal expectations for technical expertise in doing his job" and "I honestly believe this officer has all the technical skills necessary to do this job well". A conventional agree-disagree rating scale was used, and a reliability coefficient of .70 was obtained using the Cronbach alpha method.

Managerial Competence. The managerial competence of the officer as rated by the supervisor was measured with four items such as "This officer meets my own personal expectations for managerial and supervisory expertise in doing his job" and "This officer plans and organizes his work in an effective and efficient way." Again, an agree-disagree scale was used, and the Cronbach alpha was .81 for the four items.

Knowledge of the CE Organization and Mission. One item was used to measure the supervisor's assessment of the

officer's knowledge of the CE organization and mission. The statement, "I honestly believe this officer has all the knowledge of each of the branches of Civil Engineering necessary to perform this job well," was used for this purpose.

### Procedure

There were two different data collection procedures used in this study. The first procedure involved the administration of the survey to students at the AFIT Introduction to Base Civil Engineering course. This occurred twice, once in January 1985 and once in March 1985. Participation was voluntary. Each officer, who met the junior officer criteria, was given an officer questionnaire to complete during class time and a supervisory questionnaire to take back to his supervisor. The supervisor was asked to complete and return the survey in the mailing envelope provided. Response sheets were coded such that each officer's response could be linked to his supervisor's response.

The second procedure involved mailing a survey package to selected officers. Again, participation was voluntary. The package contained an officer and supervisory questionnaire, two coded response sheets, and two return envelopes. The two questionnaires were to be completed separately and mailed separately to insure confidentiality and anonymity. No records were kept of individual names, only code numbers to match officers with their respective supervisors.

All responses were included in the data file, even those with missing data. Each officer response was paired with the respective supervisory response. If a case had missing data for a certain variable, that case was not used for the analysis of that variable.

A total of 268 officer and 268 supervisory questionnaires were mailed out and 188 officer and 149 supervisory responses were received for return rates of 70 and 56 percent, respectively. The total number of cases from all three samples was 250 officer responses and 174 supervisory responses constituting overall response rates of 76% for officers and 53% for supervisors.

Once the questionnaires were returned, they were machine read into a computer file, and any responses the machine missed were input manually. Each officer response was paired with the appropriate supervisory response. A total of 16 responses were returned blank, 5 officer responses and 11 supervisory responses. Of the 250 officer responses, 158 had complete supervisory responses to match them. Thus 63% of the returned cases were complete.

### Analyses

There were two statistical techniques used in the analysis of the survey data. The first analysis technique involved the use of Pearson correlation coefficients. They were employed to determine if time in service, prior service, the number of courses attended at AFIT, and the subject

matter at AFIT courses were correlated with the sense of competence of the officer as rated by himself and his supervisor. Pearson  $r$ 's were also used to determine relationships between the officer's rating of his competence and his supervisor's rating of his competence.

The second statistical analysis was the conventional mean difference test ( $t$ -test). This test was used to determine if the mean competence levels for specific groups differed (e. g. officers with civil engineering degrees vs. officers with mechanical engineering degrees). The  $t$ -test was used on the following variables: prior service, source of commission, undergraduate degree, and attendance at the AFIT Introduction to Base Civil Engineering course. In addition, a paired  $t$ -test was performed to determine if there was a difference in the officer's self-rating of competence compared to those of his or her supervisor.

## IV. RESULTS

### Introduction

This chapter presents the results of the analyses performed in this study. First, the correlations between the officer and supervisory ratings will be presented and discussed. Then the results of tests of each of the eight hypotheses will be presented.

### Officer-Supervisor Correlations

The intercorrelation matrix for officer and supervisory ratings of competence is shown in Table 1. Significant correlations between the officer ratings and the supervisory ratings were obtained (values in parentheses). These results indicate some evidence of convergent validity. Convergent validity is a measure of how well two instruments measure the same construct. In particular, the correlation between the officer's rating of his overall competence and his supervisor's rating of his overall competence was fairly strong with an  $r$  value of .36. This correlation was the largest of any of the officer-supervisor ratings.

The officer and supervisory ratings of technical competence were also significantly correlated with  $r = .17$ . The correlation between supervisory and subordinate ratings of knowledge of the CE organization and mission was only marginally significant, and there was no significant correlation between the ratings of managerial competence. Thus, the convergent validity evidence was not as strong for the

TABLE 1  
Correlations Between Officer and Supervisory Ratings of Task Competence

Variable	1	2	3	4	5	6	7
<u>Officer Self-Ratings</u>							
1. Overall Competence							
2. Technical Competence	.73***						
3. Managerial Competence	.44***	.42***					
4. Knowledge	.40***	.36***	.42***				
<u>Supervisory Ratings</u>							
5. Overall Competence	(.36)***	.26***	.21***	.10			
6. Technical Competence	.25***	(.17)**	-.04	.06	.72***		
7. Managerial Competence	.19**	.07	(.10)	.06	.77***	.68***	
8. Knowledge	.19**	.05	.09	(.15)*	.65***	.54***	.64***

\*  $p < .10$     \*\*  $p < .05$     \*\*\*  $p < .01$

measures of technical competence and background knowledge. There was no evidence of convergent validity for the measure of managerial competence.

The intercorrelations between the officer ratings of overall competence, technical competence, managerial competence, and knowledge were all very strong. Likewise, the intercorrelations among the supervisory ratings were also very strong. These correlations seem to suggest a potential halo effect, since a high rating in one of the competence measures usually corresponded with a high rating in the other competence measures, as well.

The very strong correlation (.73) between officer self-rated technical competence and overall competence should also be noted. This correlation is much stronger than the officer self-rated overall competence-managerial competence correlation (.44) and the overall competence - knowledge correlation (.40).

Table 2 is the intercorrelation matrix between officer and supervisory correlations for the Wagner and Morse (1975) factors. These results also present evidence of convergent validity (results in parentheses). There were high correlations between the officer and supervisory ratings of overall competence ( $r = .31$ ), task knowledge ( $r = .26$ ), and confidence ( $r = .43$ ). These correlations between the officer and supervisory ratings of the same competence measure were generally higher than other correlations.

TABLE 2

Correlations Between Officer and Supervisory Ratings for  
Wagner and Morse Competence Factors

Variable	1	2	3	4	5	6
<u>Officer Self-Ratings</u>						
1. Overall Competence						
2. Task Knowledge	.35***					
3. Influence	.54***	.39***				
4. Confidence	.23***	.54***	.20***			
<u>Supervisory Ratings</u>						
5. Overall Competence	(.31)***	.04	.25***	.05		
6. Task Knowledge	.12	(.26)***	.06	.29***	.15*	
7. Confidence	.16**	.25***	.10	(.43)***	.24***	.79***

\*  $p < .10$ \*\*  $p < .05$ \*\*\*  $p < .01$

## Tests of Hypotheses

Hypothesis 1. Hypothesis 1 stated that there will be a positive relationship between time in service and competence. The results displayed in Table 3 support this hypothesis for officer self-rated competence but not for supervisory-rated competence. All of the self-rated competence measures had significant correlations with time in service, and overall competence and knowledge of the CE organization and mission had the highest relationship with this variable. The supervisory-rated overall competence and knowledge measures were weakly correlated with time in service but were not significant.

The relationship between time in service and the four Morse and Wagner (1975) factors yielded similar results. Table 4 indicates there were significant correlations between time in service and the officer self-rating scores for overall competence, task knowledge, and confidence. The correlation between time in service and influence was only marginally significant ( $p < .10$ ) and there were no significant correlations between time in service and any of the supervisory ratings.

Hypothesis 2. The second hypothesis proposed that those officers with prior enlisted service would be rated higher in overall competence, managerial competence, and knowledge of the CE organization and mission than those

Table 3  
Time in Service - Competence Correlations

Variable	r
<u>Officer Self-Ratings</u>	
Overall Competence	.33***
Technical Competence	.15**
Managerial Competence	.19***
Knowledge	.37***
<u>Supervisory Ratings</u>	
Overall Competence	.11
Technical Competence	.02
Managerial Competence	.07
Knowledge	.11
* p < .10    ** p < .05    *** p < .01	

TABLE 4  
Time in Service - Wagner and Morse Factor Correlations

Variable	r
<u>Officer Self-Ratings</u>	
Overall Competence	.13***
Task Knowledge	.28***
Influence	.11*
Confidence	.45***
<u>Supervisory Ratings</u>	
Overall Competence	.13
Task Knowledge	.06
Confidence	.07

\*  $p < .10$     \*\*  $p < .05$     \*\*\*  $p < .01$

officers without prior enlisted service. The results presented in Tables 5 and 6 do not support this hypothesis. The t-test results in Table 5 show that there were no significant differences between prior service officers and non-prior service officers on any of the competence measures. In addition, Table 6 shows that Wagner and Morse's (1975) influence factor is the only one of the four factors significantly correlated with prior service.

Hypothesis 3. Determining the effect of source of commission on competence was the objective of this hypothesis. It was hypothesized that officers who were commissioned through Officer Training School or the Air Force Academy would be rated higher in knowledge of the CE organization and mission than officers who received their commissions through the Reserve Officer Training Corps.

Table 7 presents the results of mean difference tests and shows that officers commissioned through OTS rated themselves significantly higher in knowledge of the CE organization and mission than officers who were commissioned through ROTC. This result was not replicated by the supervisory ratings though as there were no significant differences on the supervisory ratings of OTS and ROTC officers. Table 7 also illustrates that there were no significant differences in knowledge between officers commissioned through ROTC and through the Air Force Academy.

TABLE 5

Mean Difference Test between Prior Service and Non-Prior Service Officers

Variable	<u>No Prior Service</u>		<u>Prior Service</u>		t	p
	M	SD	M	SD		
<u>Officer Self-Ratings</u>						
Overall Competence	86.3	17.6	90.3	16.2	1.64	.10
Technical Competence	27.8	6.8	28.7	5.9	1.03	.30
Managerial Competence	28.5	6.0	29.5	5.5	1.21	.23
Knowledge	16.9	5.9	17.5	16.9	.75	.45
<u>Supervisory Ratings</u>						
Overall Competence	49.0	9.2	49.2	10.0	.08	.94
Technical Competence	17.4	3.2	16.5	4.0	-1.48	.14
Managerial Competence	21.5	4.8	21.5	5.5	.00	.99
Knowledge	5.1	1.7	5.1	1.7	.06	.96

TABLE 6

Prior Service - Wagner and Morse Factor Correlations

Variables	r
<u>Officer Self-Ratings</u>	
Overall Competence	.10
Task Knowledge	.04
Influence	.15*
Confidence	.10
<u>Supervisory Rating</u>	
Overall Competence	.01
Task Knowledge	.07
Confidence	.03

\*  $p < .05$

TABLE 7  
Mean Difference Tests for Three Sources of Commission

Variable	<u>ROTC (1)</u>		<u>OTS (2)</u>		<u>USAF (3)</u>		$t_{1-2}$	$t_{1-3}$
	M	SD	M	SD	M	SD		
Officer Self-Rated Knowledge	15.8	6.0	18.1	5.6	15.5	5.6	3.03*	-.15
Supervisor Rated Knowledge	5.1	1.7	5.1	1.7	5.2	1.3	-.09	.12

\*  $p < .01$

Hypothesis 4. This hypothesis stated that officers with civil engineering undergraduate degrees would be rated higher in overall competence, technical competence, and knowledge of the CE organization and mission than officers with electrical, industrial, or mechanical engineering degrees. The results are presented in Table 8.

This hypothesis was not supported since none of the  $t$ -values were significant in the hypothesized direction. The only significant difference was for technical competence between civil engineers and electrical engineers and this result found the electrical engineers had significantly higher competence ratings than the civil engineers.

The hypothesis concerning academic degrees did not address the competence ratings of architects. But a mean difference test was performed to compare the competence levels of architects and civil engineers and the results indicate that architects rated themselves significantly higher than civil engineers in overall competence ( $p < .05$ ) and technical competence ( $p < .01$ ). The supervisory measures indicated no significant differences between the two types of degrees.

Hypothesis 5. This hypothesis concerned the effect of the AFIT Introduction to Base Civil Engineering course on overall competence and knowledge of the CE organization and mission. It was hypothesized that those officers who had attended the Introduction to Base Civil Engineering course

TABLE 8

Mean Difference Tests for Academic Degrees

Variable	<u>Civil (1)</u>		<u>Elec (2)</u>		<u>Indus (3)</u>		<u>Mech (4)</u>		$t_{1-2}$	$t_{1-3}$	$t_{1-4}$
	M	SD	M	SD	M	SD	M	SD			
<u>Officer Self-Ratings</u>											
Overall Competence	86.2	17.1	89.9	14.2	87.1	16.2	86.5	19.5	-1.03	-.25	-.07
Technical Competence	27.1	7.1	29.3	4.7	28.6	5.4	27.6	6.7	-2.07*	-1.08	-.40
Knowledge	17.6	5.6	17.0	4.9	17.2	5.4	16.5	6.8	.56	.36	1.00
<u>Supervisory Ratings</u>											
Overall Competence	48.8	9.6	49.5	7.7	52.2	8.4	46.8	9.9	-.31	-1.45	.84
Technical Competence	17.3	3.7	17.8	2.4	17.2	3.6	16.6	3.2	-.70	.06	.77
Knowledge	5.2	1.5	5.0	1.8	5.4	1.8	4.8	1.9	.59	-.44	1.17

\*  $p < .05$

would be rated higher in these two competence measures than officers who had not attended the course. The test results in Table 9 do not support this hypothesis. There were no significant differences in competence between officers who had attended the Introduction to Base Civil Engineering course and officers who had not attended the course.

Hypothesis 6. A positive correlation between the number of courses attended at the AFIT School of Civil Engineering and competence was hypothesized. Specifically, positive correlations were expected between the number of courses taken and overall competence, technical competence, and background knowledge. The results displayed in Table 10 supported this hypothesis with significant correlations found between all officer self-rating measures, the supervisory rating of overall competence, and the number of courses attended. The supervisory rating of technical competence and knowledge were marginally correlated with the number of courses.

Hypothesis 7. Also shown in Table 10 are the results for the hypothesis dealing with the subject matter of AFIT Civil Engineering courses. It was hypothesized that there would be a positive correlation between perceptions of how well the subject matter at AFIT prepared the officer for his job and overall competence, technical competence, and background knowledge. Some significant correlations were obtained. Officer self-ratings of overall competence and

TABLE 9  
Mean Difference Test for the Introduction to Base Civil Engineering Course

Variable	<u>No BCE Course</u>		<u>BCE Course</u>		t	p
	M	SD	M	SD		
<u>Officer Self-Ratings</u>						
Overall Competence	87.0	18.8	87.6	16.5	.24	.81
Knowledge	17.1	5.8	17.1	5.8	.10	.92
<u>Supervisory Ratings</u>						
Overall Competence	49.4	9.9	49.0	9.2	-.25	.80
Knowledge	4.9	1.8	5.3	1.6	1.17	.25

TABLE 10  
Educational Variable Correlations

Variable	<u>Number of Courses</u>	<u>Subject Matter</u>
	r	r
<u>Officer Self-Ratings</u>		
Overall Competence	.24***	.18***
Technical Competence	.16**	.16**
Knowledge	.19***	.07
<u>Supervisory Ratings</u>		
Overall Competence	.20**	.17**
Technical Competence	.13*	.09
Knowledge	.14*	.14*

\* p < .10      \*\* p < .05      \*\*\* p < .01

technical competence were significantly related to evaluations of the subject matter, but there were no significant correlations for these evaluations with knowledge of the CE organization and mission.

Supervisory ratings of overall competence were also significantly correlated with ratings of the relevance of the subject matter at AFIT. Technical competence was not significantly correlated with subject matter ratings and background knowledge was only marginally correlated with this variable.

Hypothesis 8. The final hypothesis stated that officers would rate themselves higher than their supervisors would rate them on all competence measures. It was hypothesized that leniency bias would produce this result (for examples, see Thornton, 1980). The results presented in Table 11 were quite the reverse. Mean difference tests (paired) showed that supervisors rated the officers significantly higher than the officers rated themselves on all competence dimensions. The fact that all of the differences were significant beyond the .001 level emphasizes the magnitude of this result.

TABLE 11  
Mean Difference Tests (Paired) Between Officer Ratings and Supervisory Ratings

Variable	<u>Officer Self-Ratings</u>		<u>Supervisory Ratings</u>		t
	M	SD	M	SD	
Overall Competence	4.6	.9	5.5	1.1	-9.5*
Technical Competence	4.7	1.1	5.7	1.2	-9.0*
Managerial Competence	4.8	1.0	5.4	1.3	-4.6*
Knowledge	4.4	1.5	5.1	1.7	-4.8*

\*  $p < .001$

## V. DISCUSSION

### Introduction

This chapter presents a discussion of the findings of this study and some conclusions that may be inferred from these findings. In addition, some study limitations and recommendations for further research are proposed.

### Findings

The results contained in the officer-supervisory intercorrelation matrix gave some evidence indicating the instrument used may be a valid source of competence ratings. The fact that two different data sources, officer self-ratings and supervisory ratings, were significantly correlated indicates some degree of convergence in the judgments made by the two types of raters. Likewise, the fact that there was little or no significant correlation between the officer and supervisory ratings of managerial competence and background knowledge suggests that perhaps these evaluations represented different traits, different points of view, or unreliable measures.

One reason for the difference in managerial competence ratings might be due to supervisors not observing the managerial aspects of the officer's job. The most obvious leadership and management role of an officer is that of a Prime BEEF officer. Unfortunately, most junior officer's

supervisors are civilians in the Engineering Branch who do not observe the officer in a Prime BEEF role.

Sense of competence was found to be significantly correlated with the amount of time an officer had spent in the service, and this result was expected. One would expect an officer to feel increasingly more competent with more experience in his or her job. The results also showed that confidence and knowledge of the CE organization and mission were strongly associated with time in service, but the perceived amount of influence an officer had over his or her environment was not related to time in service. This last finding may be due to the fact that most second lieutenant positions are relatively equal in degree of responsibility. Major changes in influence probably will not occur until the officer assumes a more senior position.

The hypothesis that officers with prior enlisted service would be rated more competent than officers without prior enlisted service was not supported. This finding suggests that while time in service as a CE officer affects competence, time in other career fields as an enlisted member does not appear to have an effect on sense of competence.

The results pertaining to the hypothesis dealing with an officer's source of commission implied that officers commissioned through OTS were more knowledgeable about the CE organization and mission than ROTC officers. The results

also showed that OTS officers were rated more competent than Air Force Academy officers in this background knowledge. A possible explanation for this result may be that OTS officers know which career field they will be entering when they begin OTS, and they may study and observe their career field more closely while attending OTS. In contrast, ROTC cadets are not notified of assignment to their career field until late in their senior year in college. ROTC cadets also receive their training at a civilian college so they have little opportunity to observe officers working in their career field before entering their first job. The result that officers commissioned through the Air Force Academy had lower competence ratings than either OTS or ROTC officers was a surprising result. Graduates of the Air Force Academy have spent four years in a military environment and had an opportunity to observe the Civil Engineering squadron at the Academy. One possible reason for this result might be the small sample from the Air Force Academy ( $n = 12$ ).

One of the major goals of this study was to determine if officers with civil engineering degrees felt more competent than officers with other engineering degrees. The results of this analysis revealed that there were no significant differences in self-reported competence levels between civil engineers and electrical, industrial, and mechanical engineers. It would seem that much of the course work that a civil engineering student would take in college would be

directly applicable to his or her job as a CE officer. Conversely, many of the subjects studied by electrical, industrial, and mechanical engineers are more theoretical in nature and do not provide the officer with practical job applications. For example, a mechanical engineer working as a CE officer would design heating, ventilating, and air conditioning (HVAC) systems. HVAC is only one small area of study within mechanical engineering, and a mechanical engineer might have very little exposure to and knowledge of design applications in this area of study.

One explanation for the surprising lack of significant differences in competence levels between academic degrees may be attributed to the additional Civil Engineering preparation obtained by attending technical courses at the AFIT School of Civil Engineering. Attendance at courses specifically tailored to the deficiencies of individuals from non-Civil Engineering disciplines could significantly raise the felt competence level of these CE officers. The fact that the number of courses attended at AFIT was significantly correlated with competence level adds some credibility to this explanation.

Another unexpected outcome of this study was the finding that the AFIT Introduction to Base Civil Engineering course was not significantly associated with competence ratings. This course is designed to give the officer a general overview of the whole Civil Engineering organiza-

tion, and it was hypothesized that the course would have a significant impact on sense of competence.

One possible explanation for this finding is the purpose of the Introduction to Base Civil Engineering course. This course is designed to give the new CE officer an overview of Civil Engineering, not specific task knowledge. The knowledge gained in the course may not directly affect an officer's perceived competence relating to his specific job and the technical tasks therein. Although knowledge of the CE organization is important background knowledge for every CE officer, the knowledge gained from the Introduction to Base Civil Engineering Course may not be reflected in an officer's evaluation which may be based primarily on his or her technical competence in areas such as electrical power systems design or pavements design.

We had conjectured that the number of courses attended at AFIT would be significantly correlated with competence ratings. This hypothesis was supported by the results from both CE officers and their supervisors. Since attendance at the Introduction to Base Civil Engineering course was expressly excluded from the total number of courses taken, this result lends support to the conclusion that AFIT technical courses tend to increase the perceived competence of CE officers.

It was also hypothesized that ratings of the degree to which the subject matter of AFIT courses prepared officers

for their jobs would be positively correlated with feelings of competence. This hypothesis seemed a logical extension of the linkage between course attendance and perception of task competence. The correlations obtained in this study supported this hypothesis, and the relationship was particularly strong for the overall competence measure.

It was also found that supervisors rated the CE officers significantly higher than the officers rated themselves. This result was consistently found across all of the competence measures. The high *t* values, ranging from 4.8 to 9.5, leave little doubt as to the magnitude of these differences. This result ran counter to our original hypothesis.

Performance appraisal research has tended to find that, in general, most individuals are more lenient when rating themselves than are other sources of ratings (Thornton, 1980). Although measures of sense of competence are clearly not performance appraisals, we expected that the same tendency for an individual to be lenient in rating himself would occur when evaluating personal sense of competence levels. Obviously, this expectation was not supported by the results.

It is difficult to fully comprehend the implications of this finding. This result may stem from the unique situation of the typical CE officer. Since these officers have little applied technical training, their supervisors

may not have high expectations for the junior officers. Thus, a supervisor might be impressed by any noteworthy skill or knowledge shown by the officer, and this may in turn lead to high ratings. The officers, on the other hand, might be discouraged by their lack of relevant training, especially in the technical areas. Thus, they may rate themselves as less competent.

Another possible explanation is a contrast effect. Supervisors could upgrade in their minds the competence of employees with technical engineering degrees if they compare them with the numerous semi-skilled CE employees such as draftsmen, technicians, and craftsmen. Both of these explanations are highly speculative though, and additional research is needed.

### Conclusions

Although several of the hypotheses were not supported by the results, some important conclusions may be drawn from this study.

First, the Wagner and Morse (1975) sense of competence instrument received some badly needed evidence supporting its construct validity. The validity of the modified Wagner and Morse instruments for technical competence, managerial competence, and background knowledge remain in doubt. The significant correlation between the two different sources of competence ratings takes an important step in the validation process. In addition, the study also provided some support

for the validity of three of the four component factors from the Wagner and Morse (1975) instrument. Furthermore, additional data on the reliability of these scales was also provided.

There are also several conclusions that may be drawn regarding the quality of preparation of junior CE officers. It appears that CE officers improve many of their job skills by direct hands-on experience. Their perceived competence, especially their knowledge of the CE organization and mission and their level of confidence, were increased with additional job experience.

The fact that officers commissioned through OTS felt more competent than officers commissioned through ROTC or the Air Force Academy suggested that more effort should be devoted to upgrading the familiarization of non-OTS officers with their impending new career. An effort should be made to give ROTC and Air Force Academy cadets a realistic picture of their new career. Evidence from the literature on realistic job previews suggests that better officer retention might result (McEvoy & Cascio, 1985).

Although the AFIT Introduction to Base Civil Engineering course did not have a significant effect on competence ratings, the course still undoubtedly serves a useful purpose. Although the results are inconclusive, the course might benefit from more research into areas where CE officers reported the greatest deficiencies, such as knowl-

edge of the CE organization and mission, which received the lowest competence rating. The officers rated their knowledge of the Operations branch as the lowest of the branches, but this was to be expected since most of the officers worked in the Engineering and Environmental Planning branch.

The strong correlations between the total number of AFIT courses taken and feelings of competence indicate that AFIT Civil Engineering courses are meeting their intended objectives. Civil Engineering officers seem to be benefiting from these courses. These results suggest that attendance at AFIT courses can significantly raise the sense of competence of junior CE officers. Attendance at these courses should be strongly encouraged early in a junior officer's career.

Overall, the preparation of junior CE officers seems to be more adequate than we anticipated. There seem to be no glaring preparation weaknesses, although more effort is needed to prepare ROTC and Air Force Academy cadets and more emphasis should be placed on early attendance at AFIT courses. One very surprising result was that academic degree had no significant effect on competence. This was a major thrust of the study and the hypothesis seemed logical. The data did not support the hypothesis, but it was useful to find out that an officer's academic degree has no significant effect on competence.

The one big question that remains concerns the differences in magnitude between the officer self-ratings and their supervisor's ratings. The fact that officers rate themselves significantly lower than their supervisors rate them raises many questions about the differences between the processes of self-evaluation versus other person's perception. The reason for this could be an inflated supervisory rating or an underestimate of competence by the officers. This second alternative could be a serious problem if it is indeed the reason for the difference in ratings. As the literature reviewed previously indicates, many negative characteristics are associated with a low sense of competence. Further work in this area is clearly in order.

#### Study Limitations

Although care was taken to eliminate or at least minimize limitations, there are several limitations that should be noted. First, this was a cross-sectional study, with measures taken at one point in time. A cross-sectional study makes it difficult to determine any causal relationships between variables. Unlike a longitudinal study, a cross-sectional study only allows educated guesses at causal relationships.

Another possible weakness of the study was the small sample size. Although the total number of respondents was reasonably adequate, the sample sizes of specific groups (i.e. industrial engineers and Air Force Academy officers)

were small enough that a few responses could potentially alter the results.

Another factor that must be considered when examining the results of this study is the population itself. This population may be atypical when compared to individuals in other technical fields. The military is a unique environment and there are many demands levied upon a new CE officer that his civilian counterpart may never encounter. Thus, the results of this study may not be entirely applicable to other populations of individuals.

#### Recommendations for Further Research

The following recommendations for additional research are made to address questions raised by this investigation.

1. Future research may address the process of familiarization of ROTC cadets with their job in the U.S. Air Force. Current methods of assigning cadets to career fields should be reviewed and methods such as realistic job previews may be considered for possible use.
2. The subject matter in the AFIT Introduction to Base Civil Engineering course may be reviewed to determine if it is meeting the needs of current junior officers. Job tasks, knowledge, and skills of junior CE officers should be examined to determine exactly where the deficiencies lie with respect to the reported low perceived competence

in knowledge of the CE organization. Once determined, these deficiencies should be compared to the current curriculum to determine where the Introduction to Base Civil Engineering course could use additional emphasis to improve the perceived competence of junior CE officers.

3. A more in-depth analysis of AFIT courses may be performed to analyze specific courses and their impact on competence ratings. This research could examine such courses as Pavements Engineering, Electrical Engineering, and Heating, Ventilating and Air Conditioning to determine their effect on an officer's sense of competence. Such an analysis could be used to identify and promote those courses that are most likely to significantly increase junior CE officer competence. The AFIT School of Civil Engineering and the Major Air Commands could then work to insure all junior CE officers attend these courses.
4. Further research may examine the difference in the magnitude of officer and supervisory evaluations. More research is needed to determine the information processing differences between officer self-assessments of competence and their supervisory ratings of competence. Comparisons between concurrent performance evaluations may

reveal similarities and differences in the ways  
in which performance and competence are evaluated.

# Appendix A: Demographic Data of Sample

## TIME AMOUNT OF ACTIVE DUTY SERVICE

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
00-3 MONTHS	1	20	7.8	9.1	8.1
04-6 MONTHS	2	53	20.5	21.5	29.6
07-12 MONTHS	3	43	16.7	17.4	47.0
013-18 MONTHS	4	63	24.4	25.5	72.5
019-24 MONTHS	5	47	18.2	19.0	91.5
0OVER 24 MONTHS	6	21	8.1	8.5	100.0
0OUT OF RANGE		11	4.3	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

## PRISER PRIOR SERVICE

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
0HAS PRIOR SERVICE	1	70	27.1	28.5	28.5
0NO PRIOR SERVICE	2	176	68.2	71.5	100.0
0OUT OF RANGE		12	4.7	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

COMM SOURCE OF COMMISSION

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
OROTC	1	93	36.0	37.7	37.7
OOTS	2	142	55.0	57.5	95.1
OUSAFA	3	12	4.7	4.9	100.0
OUT OF RANGE		11	4.3	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

DEGREE UNDERGRAD ACADEMIC DEGREE

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
OARCH	1	32	12.4	13.0	13.0
OCIVIL	2	109	42.2	44.1	57.1
OELC	3	30	11.6	12.1	69.2
OGENERAL	4	2	0.8	0.8	70.0
OINDUSTRIAL	5	30	11.6	12.1	82.2
ONECH	6	37	14.3	15.0	97.2
OTHER	7	7	2.7	2.8	100.0
OUT OF RANGE		11	4.3	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

PRIEXP PRIOR ENGINEERING WORK EXPERIENCE

CATEGORY LABEL	CODE	RELATIVE			
		ABSOLUTE	FREQUENCY	ADJUSTED	CUMULATIVE
		FREQUENCY	(PERCENT)	FREQUENCY	ADJ FREQ
			(PERCENT)	(PERCENT)	(PERCENT)
CHONE	1	160	62.0	65.0	65.0
OLESS THAN 6 MONTHS	2	32	12.4	13.0	78.0
06-12 MONTHS	3	24	9.3	9.3	87.8
OMORE THAN 12 MONTHS	4	30	11.6	12.2	100.0
OGOUT OF RANGE		12	4.7	MISSING	100.0
TOTAL		258	100.0	100.0	

JOB BASE CE SECTION

CATEGORY LABEL	CODE	RELATIVE			
		ABSOLUTE	FREQUENCY	ADJUSTED	CUMULATIVE
		FREQUENCY	(PERCENT)	FREQUENCY	ADJ FREQ
			(PERCENT)	(PERCENT)	(PERCENT)
ODEED	1	117	45.3	47.4	47.4
ODEEV	2	42	16.3	17.0	64.4
ODEEC	3	28	10.9	11.3	75.7
ODEP	4	5	1.9	2.0	77.7
ODEMP	5	6	2.3	2.4	80.2
ODEI	6	29	11.2	11.7	91.9
ODOTHER	7	20	7.8	8.1	100.0
OGOUT OF RANGE		11	4.3	MISSING	100.0
TOTAL		258	100.0	100.0	

BCE ATTENDANCE AT AFIT BCE COURSE

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
ATTENDED	1	174	67.4	71.0	71.0
NOT ATTENDED	2	71	27.5	29.0	100.0
OUT OF RANGE		13	5.0	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

NUMCRS NUMBER OF AFIT CE

COURSES NOT INCL

CATEGORY LABEL	CODE	RELATIVE ADJUSTED CUMULATIVE			
		ABSOLUTE	FREQUENCY	FREQUENCY	ADJ FREQ
		FREQUENCY	(PERCENT)	(PERCENT)	(PERCENT)
ONE	1	109	42.2	44.1	44.1
TWO	2	79	30.6	32.0	76.1
THREE	3	44	17.1	17.8	93.9
FOUR	4	12	4.7	4.9	98.8
FIVE	5	2	0.8	0.8	99.6
SIX OR MORE	6	1	0.4	0.4	100.0
OUT OF RANGE		11	4.3	MISSING	100.0
		-----	-----	-----	
TOTAL		258	100.0	100.0	

## Appendix B: Officer Survey Instrument

### OFFICER QUESTIONNAIRE

#### I. Background Information.

1. How many months of active duty military service do you have as a Civil Engineering Officer?
  1. 0-3 months
  2. 4-6 months
  3. 7-12 months
  4. 13-18 months
  5. 19-24 months
  6. more than 24 months
2. Did you have any active duty military service before you became a Civil Engineering Officer?
  1. yes
  2. no
3. What was your source of commission?
  1. ROTC
  2. OTS
  3. U.S. Air Force Academy
  4. Other \_\_\_\_\_.
4. In which engineering discipline did you receive your undergraduate degree?
  1. Architectural
  2. Civil
  3. Electrical
  4. General
  5. Industrial
  6. Mechanical
  7. Other (specify) \_\_\_\_\_.
5. In which Base Civil Engineering section are you currently working?
  1. Engineering Design (DEED)
  2. Environmental and Contract Planning (DEEV)
  3. Contract Management (DEEC)
  4. Readiness (DER)
  5. Requirements/Logistics (DEMR)
  6. Industrial Engineering (DEI)
  7. Other (specify) \_\_\_\_\_.

6. How much engineering work experience (related to your present job) did you have before you became a Civil Engineering Officer?
  1. no previous experience
  2. less than 6 months
  3. 6-12 months
  4. more than 12 months
7. Have you attended the Base Civil Engineering Course at AFIT's School of Civil Engineering?
  1. yes
  2. no
8. How many courses (not including the Base Civil Engineering course) have you attended at AFIT's School of Civil Engineering?
  1. none
  2. one
  3. two
  4. three
  5. four
  6. more than four
9. How well did the subject matter covered in your AFIT Civil Engineering courses prepare you for your current job?
  1. I have never attended an AFIT course
  2. The subject matter did not prepare me at all
  3. The subject matter prepared me a little
  4. The subject matter prepared me well
  5. The subject matter prepared me exceptionally well

II. Job Attitudes- This section is designed to measure your general feelings in mastering your organization and work setting. Your feelings about specific abilities such as technical or managerial ability will be measured in later sections. Use the following rating scale to indicate the extent to which you agree or disagree with the statements shown below.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

10. No one knows this job better than I do.

11. Problems here are easy to solve once you understand the various consequences of your actions, a skill I have acquired.

12. Even though the work here could be rewarding, I am frustrated and find motivation continuing only because of my paycheck.

13. I meet my own personal expectations for expertise in doing this job.

14. I do not know as much as my predecessor did concerning this job.

15. I would make a fine model for an apprentice to emulate in order to learn the skills he would need to succeed.

16. This job is manageable and any problems tend to be optimally solved.

17. If anyone here can find the answer, I'm the one.

18. Sometimes I feel like I'm not getting anything done.

19. This job offers me a chance to test myself and my abilities.

20. This type of work offers subjective rewards; the job is valuable to me for no other reason than I like to do it.

21. I go home the same way I arrive in the morning, feeling I have not accomplished a whole lot.

22. My talents, or where I can concentrate my attention best, are found in areas not related to this job.
23. Considering the time spent on the job, I feel thoroughly familiar with my job.
24. If the work were only more interesting I would be motivated to perform better.
25. I honestly believe I have all the skills necessary to perform this job well.
26. Doing this job well is a reward in itself.
27. I can get so wrapped up in my work that I forget what time it is and even where I am.
28. Mastering this job means a lot to me.

III. Technical Job Demands- This section is designed to measure your feelings and confidence about your ability in the technical aspects of your job (e.g. engineering design, cost estimates, engineering studies, etc.). The same rating scale will be used.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

29. I meet my own personal expectations for technical expertise in doing this job.
30. This job is technically manageable and any problems tend to be optimally solved.
31. This job offers me a chance to test myself and my technical abilities.
32. My talents, or where I can concentrate my attention best, are found in areas not related to the technical aspects of this job.
33. I honestly believe I have all the technical skills necessary to perform this job well.
34. If I were deployed with a Prime BEEF team, I could solve any technical problems that might arise.

IV. Managerial and Supervisory Job Demands- This section is designed to measure your feelings and confidence in managing work and supervising subordinate employees. The same rating scale will be used.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

- 35. I meet my own personal expectations for managerial and supervisory expertise in doing this job.
- 36. This job offers me a chance to test myself and my managerial and supervisory abilities.
- 37. My talents, or where I can best concentrate my attention, are found in areas not related to the managerial and supervisory aspects of this job.
- 38. I honestly believe I have all the managerial and supervisory skills necessary to perform this job well.
- 39. I plan and organize my work in an effective and efficient way.
- 40. I could effectively manage and lead a deployed Prime BEEF team as a team chief.

V. Background Knowledge of Civil Engineering Branches. This section is designed to measure your feelings and confidence of your knowledge of the Civil Engineering organization and mission. Again, the same rating scale will be used.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

- 41. I honestly believe I have all the knowledge of each of the branches of Civil Engineering necessary to perform this job well.

- 42. I honestly believe I have all the knowledge of the Engineering and Environmental Planning Branch (DEE) necessary to perform this job well.
- 43. I honestly believe I have all the knowledge of the Operations Branch (DEM) necessary to perform this job well.
- 44. I honestly believe I have all the knowledge of the Prime BEEF program to perform this job well.

VI. Additional Comments-

## Appendix C: Supervisor Survey Instrument

### SUPERVISOR QUESTIONNAIRE

- I. Job Attitudes- This section is designed to measure your general feelings about the officer's success in mastering his organization and work setting. Your feelings about the officer's specific abilities such as technical or managerial ability will be measured in sections II and III. Use the following rating scale to indicate the extent to which you agree or disagree with the statements shown below.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

1. No one knows this job better than this officer does.
2. This officer meets my own personal expectations for expertise doing his job.
3. This officer does not know as much as his predecessor did concerning his job.
4. This officer would make a fine model for an apprentice to emulate in order to learn the skills he would need to succeed.
5. If anyone can find the answer, this officer is the one.
6. This job offers the officer a chance to test himself and his abilities.
7. This officer's talents, or where he can concentrate his attention best, are found in areas not related to his job.
8. Considering the time he has spent on the job, this officer is thoroughly familiar with his job.
9. I honestly believe this officer has all the skills necessary to perform this job well.

II. Technical Job Demands- This section is designed to measure your feelings and confidence about the officer's ability in the technical aspects of his job (e.g. engineering design, cost estimates, engineering studies, etc.). The same rating scale will be used.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

- 10. This officer meets my own personal expectations for technical expertise in doing his job.
- 11. This officer's talents, or where he can concentrate his attention best, are found in areas not related to the technical aspects his job.
- 12. I honestly believe this officer has all the technical skills necessary to perform this job well.

III. Managerial and Supervisory Job Demands- This section is designed to measure your feelings and confidence in the officer's ability to manage work and supervise subordinate employees. The same rating scale will be used.

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Slightly disagree
- 4 = Neither agree or disagree
- 5 = Slightly agree
- 6 = Moderately agree
- 7 = Strongly agree

- 13. This officer meets my own personal expectations for managerial and supervisory expertise in doing his job.
- 14. This officer's talents, or where he can concentrate his attention best, are found in areas not related to the managerial and supervisory aspects his job.
- 15. I honestly believe this officer has all the managerial and supervisory skills necessary to perform this job well.
- 16. This officer plans and organizes his work in an effective and efficient way.

17. I honestly believe this officer has all the knowledge of each of the branches of Civil Engineering necessary to perform his job well.

IV. Additional Comments-

## Bibliography

- Badin, Irwin J. and Jeffrey H. Greenhaus. "Self-Esteem, Performance, and Satisfaction: Some Tests of a Theory," Journal of Applied Psychology, 59: 722-726 (1974).
- Cleland, David J. and Dunder F. Kocaoglu. Engineering Management. New York: McGraw-Hill Book Company, 1981.
- Coelho, G. P. and others. "Use of the Student-TAT to Assess Coping Behavior in Hospitalized, Normal, and Exceptionally Competent College Freshmen," Perceptual and Motor Skills, 14: 355-365 (1962).
- Department of the Air Force, Air University, Air Force Institute of Technology, School of Civil Engineering. Professional Continuing Education Eligibility and Course Description, Wright-Patterson AFB OH, 1984.
- Department of the Air Force. The Engineering and Services Strategic Plan. Washington: HQ USAF, May 1983.
- . Officer Classification Regulation. AFR 36-1. Washington: HQ USAF, 1 March 1977.
- Donnelly, James Jr., James L. Gibson, and John M. Ivancevich. Fundamentals of Management. Plano TX: Business Publications, Inc., 1984.
- Ekpo-Ufot, Abel. "Self-Perceived Task Relevant Abilities, Rated Job Performance, and Complaining Behavior of Junior Employees in a Government Ministry," Journal of Applied Psychology, 64: 429-434 (1979).
- . "Self-Perceived Abilities- Relevant to the Task (SPART): A Potential Predictor of Labor Turnover in an Industrial Work Setting," Personnel Psychology, 29: 405-416 (1976).
- Ezekiel, R. L. "The Personal Future and Peace Corps Competence," Journal of Personality and Social Psychology (Monograph Supplement), 8: Part 2 (1968).
- Feldman, Daniel C. "A Practical Program for Employee Socialization," Organizational Dynamics, 5: 64-80 (1976).

- Friedman, A. and P. Goodman. "Wage Inequity, Self-  
Qualifications, and Productivity," Organizational  
Behavior and Human Performance, 2: 406-417 (1967).
- Gay, Forrest T. III. "Professional Development of Engi-  
neers," The Military Engineer, 72: 240-243 (1983).
- Hackman, J. R. and E. E. Lawler. "Employee Reactions to Job  
Characteristics," Journal of Applied Psychology (Mono-  
graph Supplement), 55: 259-286 (1971).
- Hall, Douglas T. A Theoretical Model of Career  
Subidentity Development in organizational Settings,"  
Organizational Behavior and Human Performance, 6: 50-76  
(1971).
- Hull, C. Hadlai, and Norman H. Nie. SPSS Update 7-9. New  
York: McGraw-Hill Book Company, 1981.
- Korman, A. K. Organizational Behavior. Englewood Cliffs  
NJ: Prentice-Hall, 1977.
- . "Toward an Hypothesis of Work Behavior," Journal of  
Applied Psychology, 54: 31-41 (1970).
- . "Self-Esteem as a Moderator of the Relationship  
Between Self-Perceived Abilities and Vocational Choice,"  
Journal of Applied Psychology, 51: 65-67 (1967).
- Lorsch, J. W. Organizations and their Members: A  
Contingency Approach. New York: Harper and Row, 1974.
- Magnuson, D. Test Theory. Reading MA: Addison-Wesley,  
1967.
- McEvoy, Glenn M. and Wayne F. Cascio. "Strategies for  
Reducing Employee Turnover: A Meta Analysis," Journal of  
Applied Psychology, 70: 342-356 (1985).
- Morris, James H. and J. Daniel Sherman. "Generalizability  
of an Organizational Commitment Model," Academy of  
Management Journal, 24: 512-526 (1981).
- Morse, John J. "Sense of Competence and Individual Manage-  
rial Performance," Psychological Reports, 38: 1195-1198  
(1976).
- Rumsey, Hal H. "Motivating Air Force Engineers," Air Force  
Engineering and Services Quarterly, 23: 39-41 (1982).

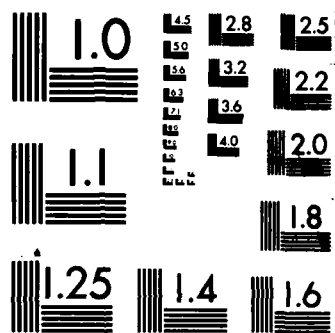
- Sekaran, Uma and Francis R. Wagner. "Sense of Competence: A Cross Cultural Analysis for Managerial Application," Group and Organizational Studies, 5: 340-352 (1980).
- Snyder, Robert A. and James H. Morris. "Reliability of the Factor Structure of the Wagner and Morse Competence Index," Psychological Reports, 43: 419-425 (1978).
- Tharenou, Phyllis and Phillip Harker. "Moderating Influence of Self-Esteem on Relationships Between Job Complexity, Performance, and Satisfaction," Journal of Applied Psychology, 69: 623-632 (1984).
- . "Organizational Correlates of Employee Self-Esteem," Journal of Applied Psychology, 67: 797-805 (1982).
- Tharenou, Phyllis. "Employee Self-Esteem: A Review of the Literature," Journal of Vocational Behavior, 15: 316-346 (1979).
- Thornton, George C. III. "Psychometric Properties of Self-Appraisals of Job Performance," Personnel Psychology, 33: 263-271 (1983).
- Wagner, Francis R. and John J. Morse. "A Measure of Individual Sense of Competence," Psychological Reports, 36: 451-459 (1975).
- Webster's Third International Dictionary. Springfield MA: G. & C. Merriam Co., 1976.
- White, R. W. "Ego and Reality in Psychoanalytic Theory," Psychological Issues, 3 (6) (1963).
- White, R. W. "Motivation Reconsidered: the Concept of Competence," Psychological Review, 5: 297-333 (1959).

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## VITA

Lieutenant Benjamin R. Wilson was born on 21 October 1960 in Newport Beach, California. He graduated from high school in Chagrin Falls, Ohio in 1978 and attended Purdue University. He received a Bachelor of Science degree in Mechanical Engineering from Purdue in 1982 and was commissioned in the Air Force through the ROTC program. From June 1982 to December 1982 he was a mechanical projects engineer for the 3902d Civil Engineering Squadron at Offutt AFB, Nebraska. In January 1983 he became the Chief of Readiness and Logistics for the 3902d CES and remained in this position until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1984.

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